



124™


DIGITAL LIVE
CONSOLE

QUICK-START GUIDE


Important Safety Instructions

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with dry cloth.
7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. Only use attachments/accessories specified by the manufacturer.
12. Use only with a cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
15. This mixer has been designed with Class-I construction and must be connected to a mains socket outlet with a protective earthing connection (the third grounding prong).
16. This mixer has been equipped with an all-pole, rocker-style AC mains power switch. This switch is located on the rear panel and should remain readily accessible to the user.
17. This apparatus does not exceed the Class A/Class B (whichever is applicable) limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.
ATTENTION — Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de class A/de class B (selon le cas) prescrites dans le règlement sur le brouillage radioélectrique édicté par les ministere des communications du Canada.
18. Exposure to extremely high noise levels may cause permanent hearing loss. Individuals vary considerably in susceptibility to noise-induced hearing loss, but nearly everyone will lose some hearing if exposed to sufficiently intense noise for a period of time. The U.S. Government's Occupational Safety and Health Administration (OSHA) has specified the permissible noise level exposures shown in the following chart.

PORTABLE CART WARNING



Carts and stands - The Component should be used only with a cart or stand that is recommended by the manufacturer. A Component and cart combination should be moved with care. Quick stops, excessive force, and uneven surfaces may cause the Component and cart combination to overturn.



CAUTION AVIS

RISK OF ELECTRIC SHOCK
DO NOT OPEN


RISQUE DE CHOC ELECTRIQUE
NE PAS OUVRIR




CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK DO NOT REMOVE COVER (OR BACK) NO USER-SERVICEABLE PARTS INSIDE REFER SERVICING TO QUALIFIED PERSONNEL

ATTENTION: POUR EVITER LES RISQUES DE CHOC ELECTRIQUE, NE PAS ENLEVER LE COUVERCLE. AUCUN ENTRETIEN DE PIECES INTERIEURES PAR L'USAGER. CONFIEZ L'ENTRETIEN AU PERSONNEL QUALIFIE.

AVIS: POUR EVITER LES RISQUES D'INCENDIE OU D'ELECTROCUTION, N'EXPOSEZ PAS CET ARTICLE A LA PLUIE OU A L'HUMIDITE

 The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure, that may be of sufficient magnitude to constitute a risk of electric shock to persons.

Le symbole éclair avec point de flèche à l'intérieur d'un triangle équilatéral est utilisé pour alerter l'utilisateur de la présence à l'intérieur du coffret de "voltage dangereux" non isolé d'ampleur suffisante pour constituer un risque d'électrocution.

 The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

Le point d'exclamation à l'intérieur d'un triangle équilatéral est employé pour alerter les utilisateurs de la présence d'instructions importantes pour le fonctionnement et l'entretien (service) dans le livret d'instruction accompagnant l'appareil.

According to OSHA, any exposure in excess of these permissible limits could result in some hearing loss. To ensure against potentially dangerous exposure to high sound pressure levels, it is recommended that all persons exposed to equipment capable of producing high sound pressure levels use hearing protectors while the equipment is in operation. Ear plugs or protectors in the ear canals or over the ears must be worn when operating the equipment in order to prevent permanent hearing loss if exposure is in excess of the limits set forth here.

Duration Per Day In Hours	Sound Level dBA, Slow Response	Typical Example
8	90	Duo in small club
6	92	
4	95	Subway Train
3	97	
2	100	Very loud classical music
1.5	102	
1	105	Tami screaming at Adrian about deadlines
0.5	110	
0.25 or less	115	Loudest parts at a rock concert

WARNING — To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.

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Chapter 1: Introduction

1.1 Evolution of the TT24 Console

The professional live sound industry has been revolutionized over the past few years by high-end digital consoles. However, mid-size digital consoles have tended to emphasize studio applications with user interfaces encumbered by features (i.e., DAW control) not critical for live applications. Some of these consoles conceal their real cost by *requiring* the purchase of additional cards to supplement their limited physical I/O.

The *TT24 Digital Live Console* is a mid-size digital mixer optimized for live sound applications. We have used our extensive expertise and experience designing analog mixers to produce a powerful, easy-to-use digital console for a wide range of applications and budgets:

- theaters and houses of worship;
- permanent concert installations;
- professional live music touring companies.

1.2 Summary of Features

- 24-bit/96 kHz mixing console designed for live applications
- 24 mic/line inputs with 4-band EQ/comp/gate/HPF/polarity invert (can be stereo linked)
- Eight line inputs with 4-band EQ (can be stereo linked)
- Instant recall of 99 snapshots with filtering
- Rear panel connections: 36x28 analog I/O; 28x28 digital I/O
- QuickMix section with 5.5-inch touch LCD, 12 push-button rotary encoders, and QuickMix buttons
- 29 100-mm motorized faders
- 28 multi-function V-Pots
- 12 Aux sends with 4-band parametric EQ + dual kill filters and compressor/limiter

- Left-Right and CTR/Mono outputs with 4-band EQ + dual kill filters and compressor/limiter
- Aux Mode enables instant monitor mixing
- 11x8 Matrix-Plus with patchable inputs
- Eight user-definable flex-groups
- 2 expansion card slots
- Dual-console linking for a maximum 96 input console
- TT control software to control and view console parameters via PC

1.2.1 Rear Panel Connections

Analog I/O

Figure 1-1 shows the rear panel analog I/O connectors except for the Group/Matrix outputs, which are shown in Figure 1-2.

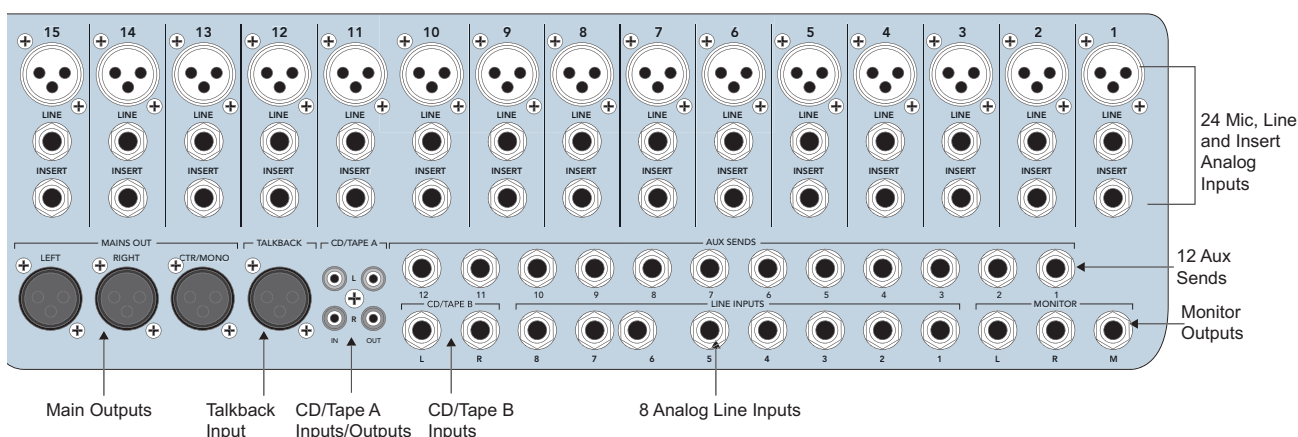


Figure 1-1 Analog I/O

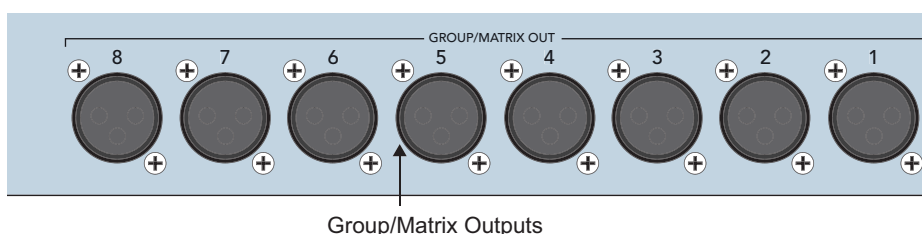


Figure 1-2 Group/Matrix connectors

Inputs

- 24 mic/line inputs with inserts (mic = balanced XLR; line = balanced TRS; inserts = unbalanced Tip Send-Ring Return)
- Eight analog line inputs (balanced TRS)
- CD/Tape A (unbalanced RCA)
- CD/Tape B (balanced TRS)
- Talkback Mic In (balanced XLR)

Outputs

- Main Left, Right, Center/Mono Outputs (balanced XLR)
- 8 Group/Matrix Outputs (balanced XLR)
- 12 Auxiliary Outputs (balanced TRS)
- CD/Tape A Outputs (unbalanced RCA)
- L-R and Mono Monitor Outputs (balanced TRS)
- Headphone Output (Stereo TRS)

Digital I/O

The rear panel digital I/O (Figure 1-3) consists of the following connectors and features:

- ADAT optical: 24 channels @ 44.1/48 kHz; 12 channels @ 88.2/96 kHz
- Stereo AES/EBU or S/PDIF with switchable input sample rate conversion and output dithering
- Word Clock
- MIDI
- USB connection for TT control software
- Two expansion cards slots offer several options:

OPT24t – expands console for 24-channel 96 kHz ADAT optical operation

U100 – links two TT24 consoles for 96-channel, 48-fader operation

UFX2 – provides four additional effects processors *or* 24 channel strips with DSP for the Digital bank

LP48 – EQ and loudspeaker processor card featuring Lake Technology's DSP

More options may be offered in the future.

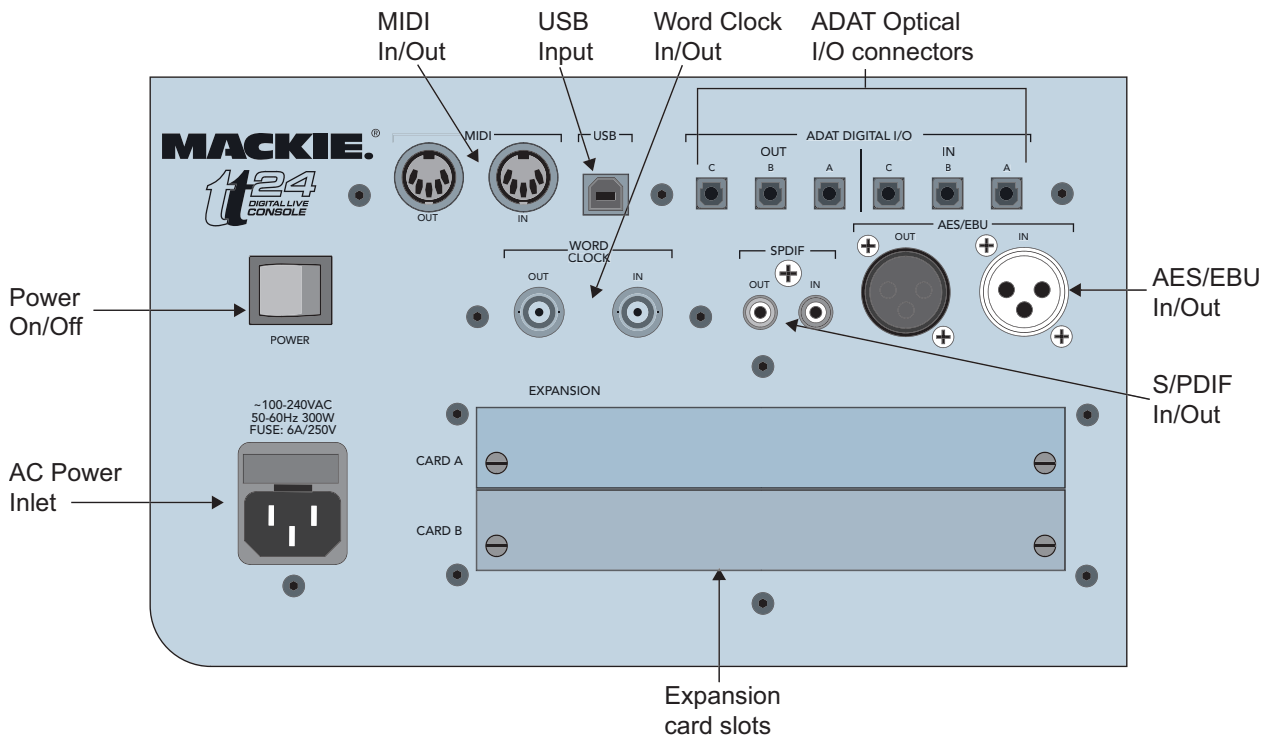


Figure 1-3 Digital I/O and expansion card slots

1.2.2 DSP Functionality

The TT24 is loaded with DSP horsepower that is distributed on inputs and outputs in a manner optimized for live sound:

24 Mic/Line Inputs

- Polarity invert
- Variable High-Pass Filter
- Gate/Expander
- Compressor/Limiter
- 4-band parametric EQ
- Stereo linking

8 Line Inputs

- 4-band parametric EQ
- Stereo linking

Main Outputs (Left, Right, CTR/Mono)

- Compressor/Limiter
- 4-band parametric EQ with dual kill filters
- **L-R + Mono** or **LCR** modes of operation

12 Aux Sends

- Compressor/Limiter
- 4-band parametric EQ with dual kill filters
- Stereo linking

8 Flex-Groups with 8 Assignable DSP Blocks

- Compressor/Limiter
- 4-band parametric EQ
- Mono, Stereo, LCR, and VCA modes of operation

8 Matrix Outputs

- Each output can have 600 ms delay.

4 Internal Stereo Effects

- Reverb
- Gated Reverb
- Mono/Stereo/Ping-Pong Delay
- Chorus
- Flanger

1.3 Terminology and Conventions

The following terms and conventions are used throughout this manual.

- Touchscreen and console *controls* are represented in bold type using their exact spelling and capitalization (i.e., press the **ANLG** bank button).
- Touchscreen and console *areas* are represented by capital letters in plain type (i.e., press the **PAN** button in the V-POT CONTROL area).
- *Activate* pertains to switches/buttons that toggle between two values and means “press the button until it lights.”
- *Deactivate* pertains to switches/buttons that toggle between two values and means “press the button until it is not lit.”
- *Touch* pertains to selection on the Touchscreen (i.e., Touch the **EQ** button).

Chapter 2: TT24 Interface

The TT24 has an intuitive easy-to-use interface. It maintains an “analog mentality,” which leverages off the engineer’s experience, while providing all the advantages of digital functionality.

The design mandate for the TT24 console interface is simply stated:

Provide quick, intuitive access to any primary live mixing function with no more than two button presses, both within easy reach of the engineer’s two hands.

Make the Touchscreen menu structure flat: no “forward” and “back” buttons or menus to wade through to access the desired function.

The following sections summarize the TT24’s major functional categories.

2.1 Channel Strip

Channel strip means one of the 24 vertical areas bounded at the bottom by a fader and at the top by the **LINE** mic/line level switch. Each channel strip can control one input at a time from one of four banks.

The top section of each channel strip (Figure 2-1) has analog controls for mic/line input switching, 48 V phantom power activation, mic/line gain control, and signal/overload LED indication.

Below that, each channel has a virtual potentiometer (V-Pot), **MUTE**, **SELECT**, and **SOLO** backlit buttons, and a 100 mm motorized fader.

The V-Pot, which performs multiple channel functions (i.e., auxiliary sends and panning), consists of a push-button rotary encoder surrounded by a 16-segment LED ring (see *V-Pot Control Area* on page 14 for details).

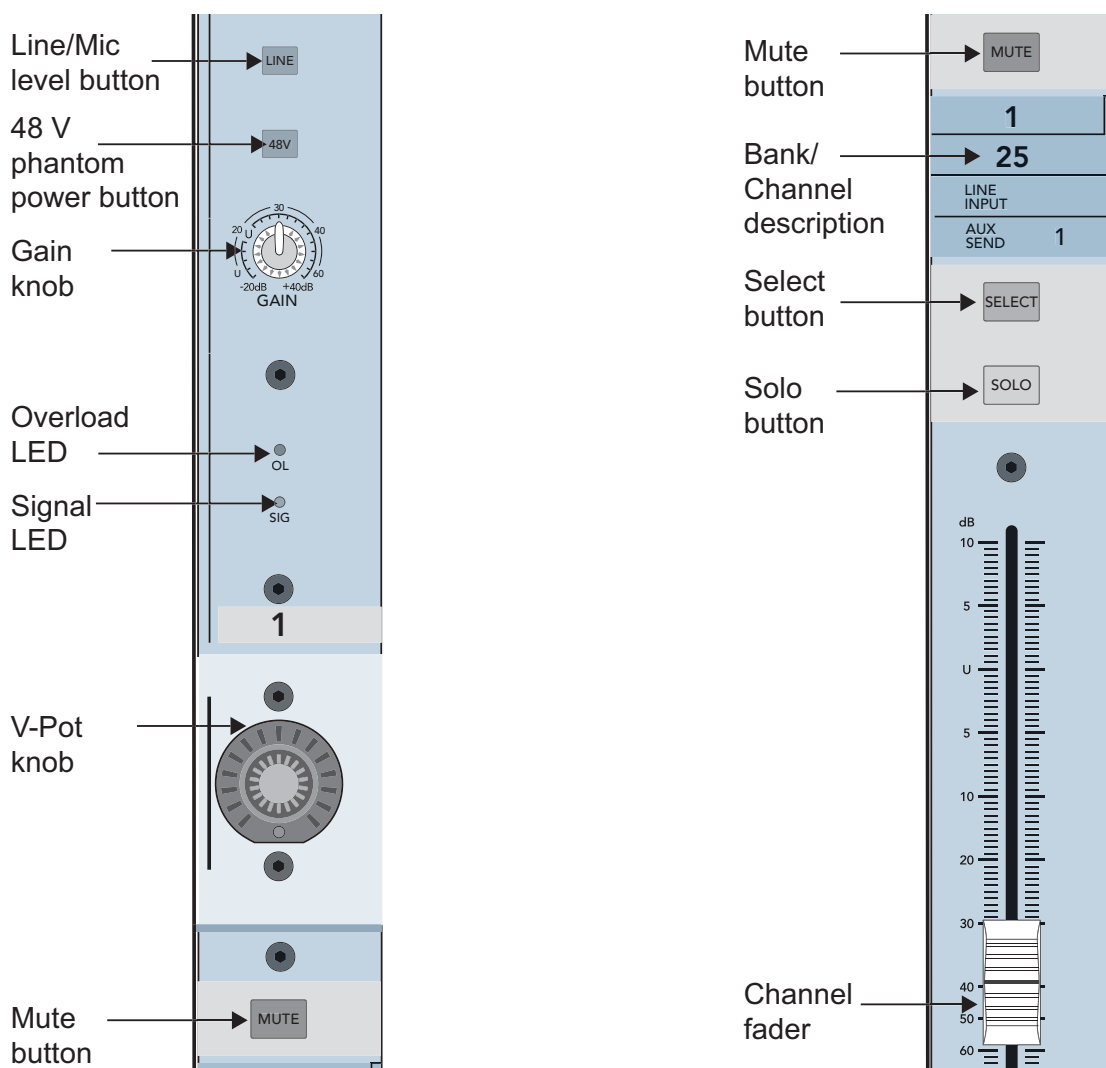


Figure 2-1 Channel strip: top (left), bottom (right)

2.2 Banks

The four Bank select buttons on the TT24 change the function of the 24 channel strips to control the following groups of channels (Figure 2-2):

ANALOG: 24 analog mic/line inputs

DIGITAL: There are 24 digital inputs from three ADAT optical connectors on the rear panel (44.1/48 kHz). At 96 kHz, there are 12 digital inputs from the three built-in connectors; another 12 are available from the optional ADAT I/O expansion card.

RETURNS:

- 1–8: Eight analog line inputs
- 9–16: Four internal stereo effects returns
- 17–24: Eight additional return channels from expansion card

MASTER: The masters bank uses the following channels:

- 1–12: Twelve Aux send masters
- 13–20: Eight Group masters
- 22–24: Left, Right, and Center/Mono Main outputs

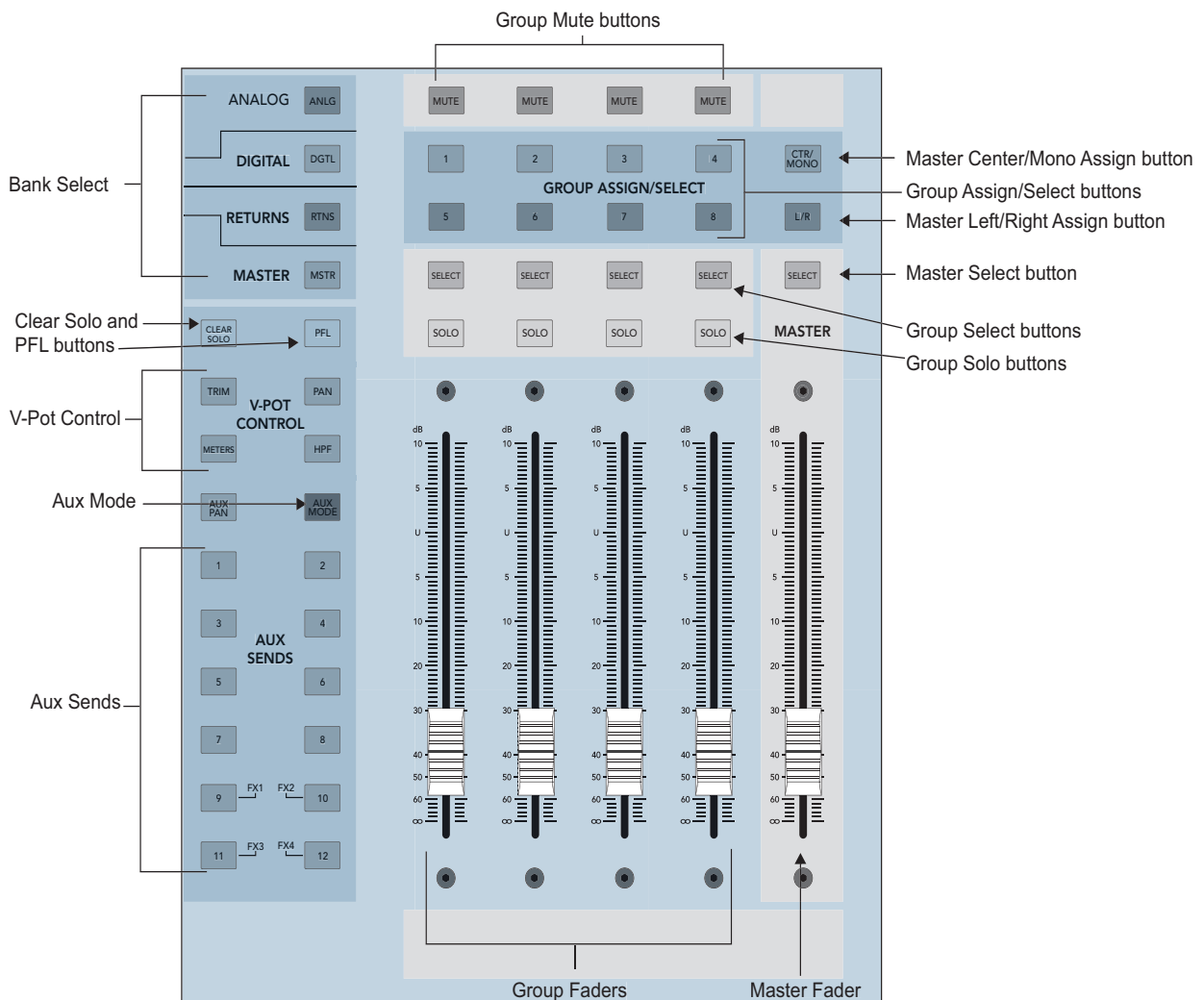


Figure 2-2 V-Pot Control, Bank Select, Group, Aux and Master sections

2.3 V-Pot Control Area

The buttons to the right of the channel faders (Figure 2-2) selects the current function for the channel V-Pots from the following:

- **PAN:** Left/Right and LCR panning control
- **TRIM:** Digital Trim has a range of ± 15 dB
- **METERS:** High-resolution channel metering. Push the V-Pot and the meter reverses to display compressor gain reduction. Rotate the knob to control the threshold settings.
- **HPF:** Push the V-Pot to engage/disengage the HPF; rotate the knob to adjust frequency between 20–400 Hz.
- **AUX SENDS 1–12:** Rotate the V-Pot to control send level; push the V-Pot to toggle pre/post fader for that send.
- **AUX PAN:** Control panning of stereo linked axes
- **AUX MODE:** Aux mode is the only blue button on the console and effectively turns the TT24 into a powerful, dedicated monitor mixer by providing aux mixing on the faders. In this mode, the 24 channel faders act as channel aux sends and the 4 group faders act as auxiliary master sends.

2.4 QuickMix Area

The upper-right of the console, below the 5.5-inch Touchscreen, is called the QuickMix area (Figure 2-3). It consists of 12 push-button rotary encoders and eight buttons, which provide fast navigation of the QuickMix section

It is important to note:

- The only adjustable controls on the Touchscreen are buttons that toggle a value on/off. All knobs represented on the Touchscreen are controlled by corresponding QuickMix knobs. If any of the 12 knobs are missing from the Touchscreen, the corresponding QuickMix knob has no function.
- Any Touchscreen knob colored white instead of black denotes a dual function available by pushing the corresponding QuickMix knob. This function varies with the control.

The four QuickMix buttons on the left instantly display information for the selected channel:

- **FAT**: overview of all parameters of a selected channel
- **EQ**: detailed control of equalizer settings
- **DYN**: detailed control of compressor/limiter and gate/expander settings
- **GRP/AUX**: Group routing and Aux level control and pre/post selection

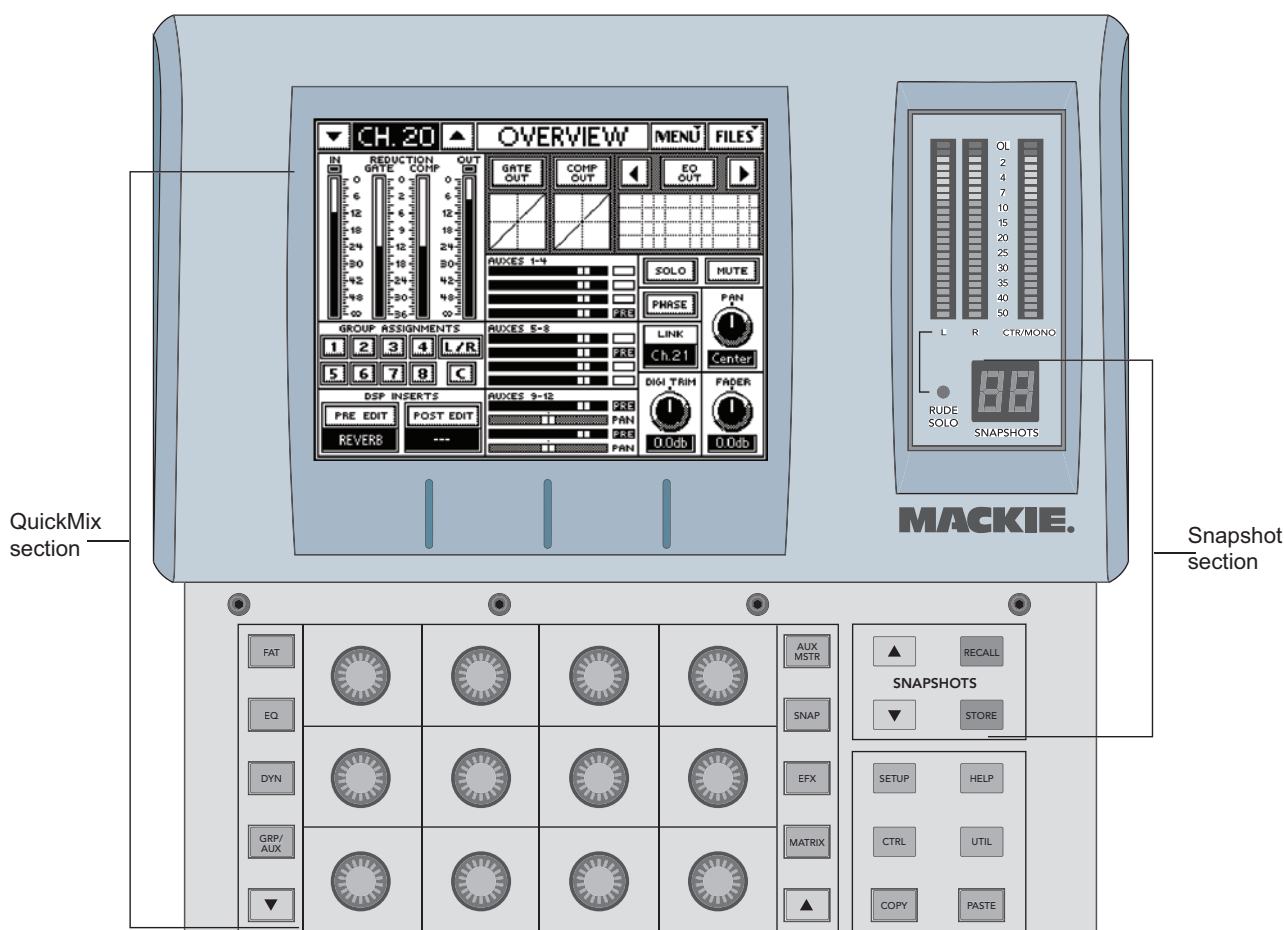


Figure 2-3 QuickMix and Touchscreen

The four QuickMix buttons on the right access configuration mixing tasks:

- **AUX MSTR** puts all 12 Aux master sends on the 12 knobs.
- **SNAP** provides detailed control of the 99 snapshots including naming, locking and filtering. All elements can be filtered out of a snapshot. For example filtering out all but mute will provide mute groups via snapshots.
- **EFX** accesses parameters and setup of the four internal effects processors.
- **MTRX** accesses the 11x8 Matrix-Plus.

2.5 Snapshots

The TT24 includes a robust snapshot feature that captures the state of the console:

- 99 snapshots
- fast store/recall surface control
- detailed snapshot filtering to store/recall only selected parameters and channels

The snapshot controls are in the upper-right area beside the QuickMix buttons (Figure 2-3).

2.6 Flex Groups and Master

The TT24 has four Group channel strips and a master strip (Figure 2-2). Each Group has a V-Pot (to control group pan), **MUTE**, **SELECT**, **SOLO** buttons, and a 100 mm motorized fader on the console surface. The four Group strips control either Groups 1–4 or 5–8. The currently selected Group bank is indicated by the **GROUP ASSIGN/SELECT** buttons.

Changing the Group Bank

Press any of the **GROUP ASSIGN/SELECT** buttons to select that Group bank. The **GROUP ASSIGN/SELECT** buttons illuminate 1–4 or 5–8 and cause the faders and buttons to snap to their previous Group bank settings.

Group Assignment

Press and hold a **GROUP ASSIGN/SELECT** button and press the channel **SELECT** buttons to add/subtract channels from that Group. This method is used for all of the **GROUP ASSIGN/SELECT** buttons (Groups 1–8, L-R and CTR/Mono).

Group Parameter Control

Press a **GROUP SELECT** button to access that Group's settings and controls in the QuickMix section just like an input channel.

2.7 Matrix-Plus

Matrix-Plus is a unique and powerful 11x8 matrix mixing tool that delivers extremely flexible matrix mixing. The matrix can only be activated by pressing the **MATRIX** button on the right side of the QuickMix area (Figure 2-3).

Once activated, the matrix uses the Group outputs. Like most 11x8 matrices, the 11 default inputs to each matrix are Groups 1–8, Left, Right, and Center. However, Matrix-Plus provides the unique ability to patch other signals into the matrix. Press the desired Group QuickMix knob to display the screen in the right side of Figure 2-4 to select the desired signals.

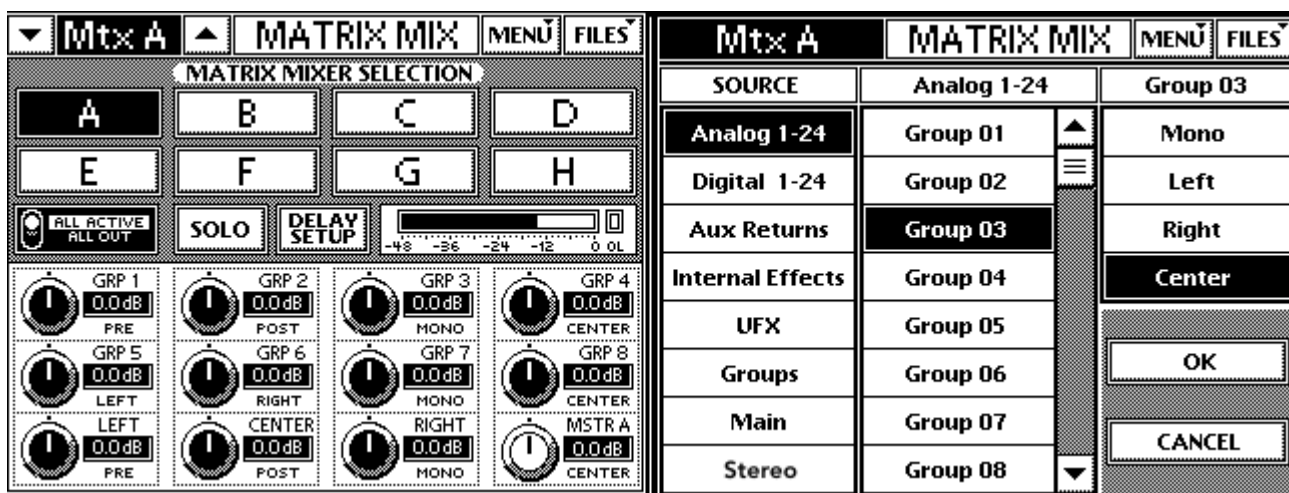


Figure 2-4 Matrix screens

The available matrix input signals are:

- Analog inputs 1–24 pre/post fader
- Digital inputs 25–48 pre/post fader
- Line inputs 1–8 pre/post fader
- Internal effects returns 1L-4R pre/post fader
- Groups 1–8 Mono, Left, Right, Center (if available)
- Main Left, Right or CTR/Mono post fader
- Expansion card return 1–8
- Stereo inputs Left and Right pre/post fader

Each matrix also has up to 600 ms delay for delayed stack applications.

2.8 Utility Area

At the top of the console, the UTILITY area contains:

Talkback: Mic preamp gain setting knob; signal (SIG) and overload (OL) LEDs

Monitor: Analog level control for the Left, Right, Mono TRS rear panel outputs

Phones: Analog level control for the front-mounted headphone jack

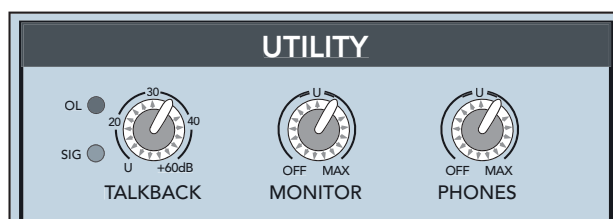


Figure 2-5 Utility area

2.9 TT Control Software

The TT control software expands the control possibilities for the TT24 console by providing:

- Remote control of all TT24 functions from a PC connected via USB.
- Improved metering and graphics than can be seen on the Touchscreen.
- Remote Show/Venue/Preset management and console→console backup/restore.
- Console firmware upgrade capability.

The TT24 connects to the PC via a USB cable (six-ft cable supplied). The minimum PC requirements are summarized below.

Table 2-1 Minimum PC Requirements

Screen Resolution	Processor Speed	Operating System
1024 x 768	600 MHz	Windows 2000 or XP

The main screens of the TT control software mirror and elaborate the Touchscreens. The TT control screens can be set to operate independently or to track the Touchscreen. When they are independent, two users may control the TT24, one from the console and one from the computer. To adjust this setting from the Touchscreen (can also be adjusted from TT control): press the QuickMix **SETUP** button, touch the **GENERAL** button from the MENU SELECTION screen, then touch to select **PC AUTO FOLLOW** to synchronize the TT control software with the Touchscreen (de-select the checkbox to make them independent).

Chapter 3: Quickstart Tutorial

This Quickstart Tutorial will help you begin using the TT24 quickly and easily by providing step-by-step instructions for its most commonly utilized tasks. Rest assured that our team of design engineers has verified these instructions!

Before beginning the Quickstart Tutorial, please read:

- Chapter 1: *Introduction* to learn about the TT24's basic attributes, and terminology/conventions for the console, Touchscreen, and user guide.
- Chapter 2: *TT24 Interface* provides a good overview of the TT24's important functional entities.

It may also be helpful to refer to Appendix A: *TT24 Configurations and Block Diagrams* to see how several useful complete systems are interconnected.

3.1 Connect Amplifier/Speakers

1. Plug in a left-right pair of amps/speakers into the **MAINS OUT LEFT** and **RIGHT XLR** connectors (Figure 3-1).
2. Connect an amp/speaker to **AUX SEND 1**.
3. Plug in headphones.

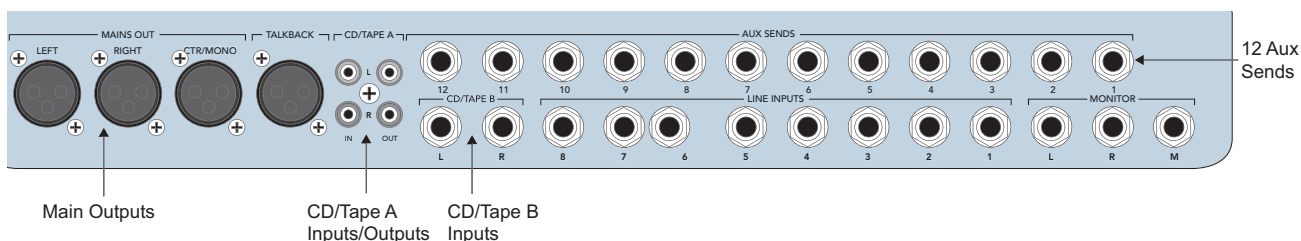


Figure 3-1 Mains and Aux Sends Outputs

3.2 Connect a Mic

This section tells you how to connect a mic to channel 1, set the gain, route to groups/auxes, and engage/adjust the variable high-pass filter.

Connect mic to channel 1

1. Plug a mic into channel 1’s XLR input (top-right of rear panel).
2. Press the **ANLG** bank select button (right of Figure 3-2).
3. Set the **LINE** switch to the up (mic) position (left of Figure 3-2).

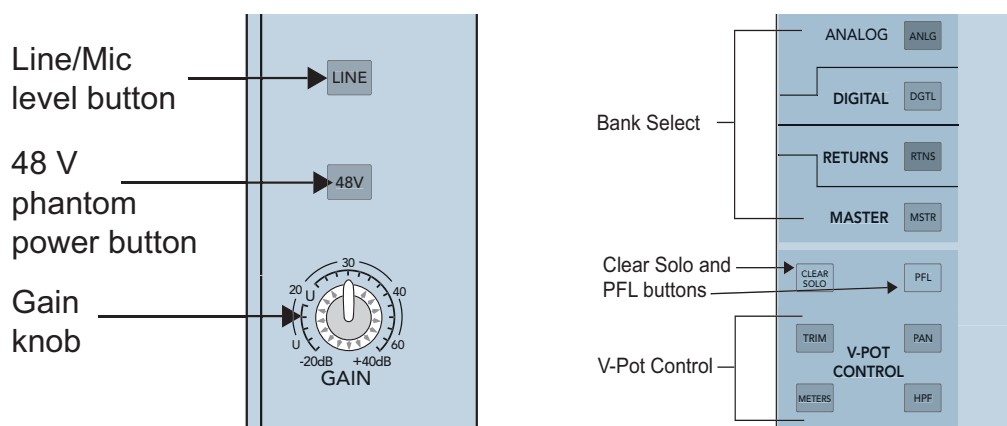


Figure 3-2 Top of channel strip (left); Bank select, Clear Solo, PFL, V-Pot control (right)

4. Set the **48V** switch to the *down* position if the mic uses phantom power; set it to the *up* position otherwise.

Set the channel gain

5. Activate the **PFL** button (right of Figure 3-2).
6. Activate channel 1’s **SOLO** button (above fader) to set gain.
7. Provide a representative signal to the mic, watch the meters to the right of the Touchscreen, and listen in phones (the phones level is in the **UTILITY** area).

The level should be between -7 and -10 dBFS.

8. Press **SOLO** again or **CLEAR SOLO** to unsolo.

Route channel 1 to Main output, Group 1, and Aux 1

9. Press and hold the **L/R** button in the GROUP ASSIGN area (Figure 3-3) and activate channel 1's **SELECT** button.

All the channel **SELECT** buttons light, indicating that all channels are routed to the Main output. You should hear your mic in the main speakers via the master fader.

Now, let's route the mic through Group 1 instead of directly to L-R:

10. Press and hold the **L/R** button in the GROUP ASSIGN area and deactivate channel 1's **SELECT** button (so it is *not* lit).

Channel 1 no longer sends signal to L/R.

11. Press and hold the **GRP1** button in the GROUP ASSIGN area and activate channel 1's **SELECT** button.

The mic is now routed to Group 1.

12. Press and hold the **L/R** button in the GROUP ASSIGN area and activate Group 1's **SELECT** button.

Group 1 is now assigned to L/R.

Use the channel, Group, and Master fader to listen to the mic signal in the L/R speakers.

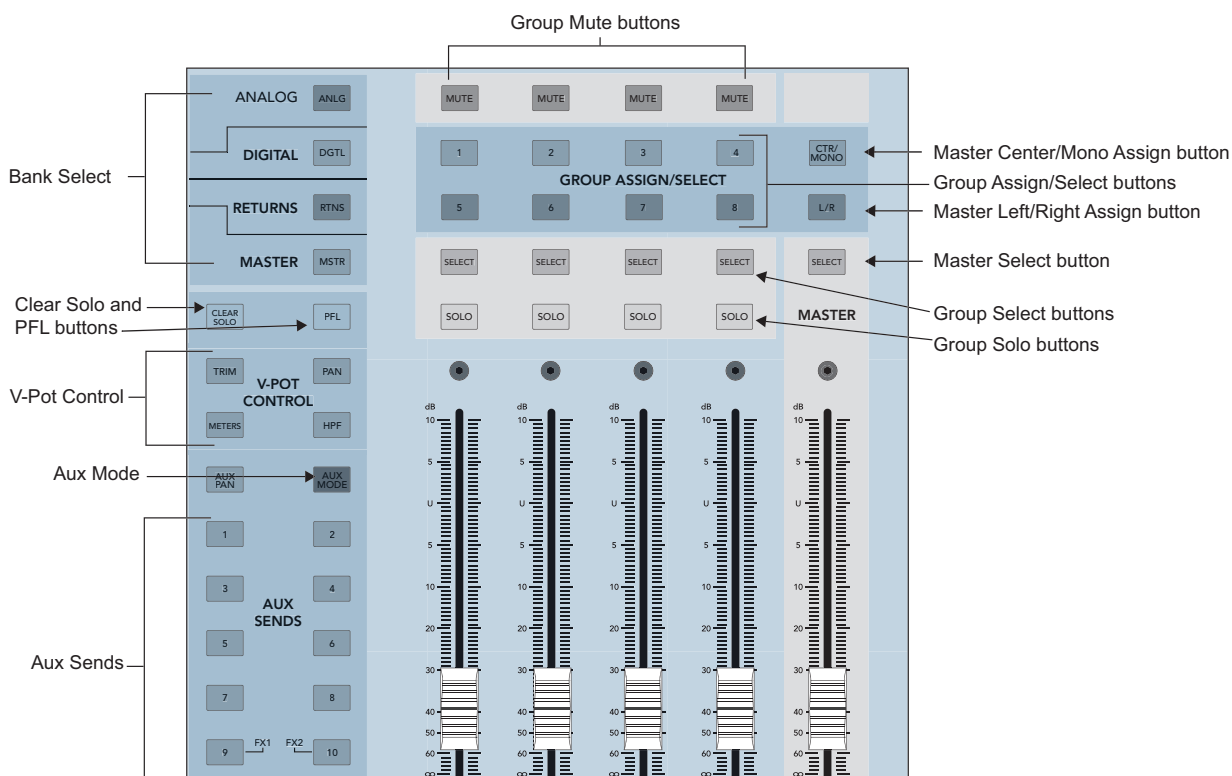


Figure 3-3 Aux, Group, and Master areas

13. Press **AUX SENDS 1** in the V-POT CONTROL area (Figure 3-3).
14. Adjust the Aux 1 level on channel 1 using the V-Pot.
15. Press the **AUX MSTR** QuickMix button (Figure 3-4).
16. Adjust Aux 1's master level with the corresponding QuickMix knob (see the Aux Master screen in Figure 3-5).

You should hear your mic in the monitor speaker attached to Aux 1.

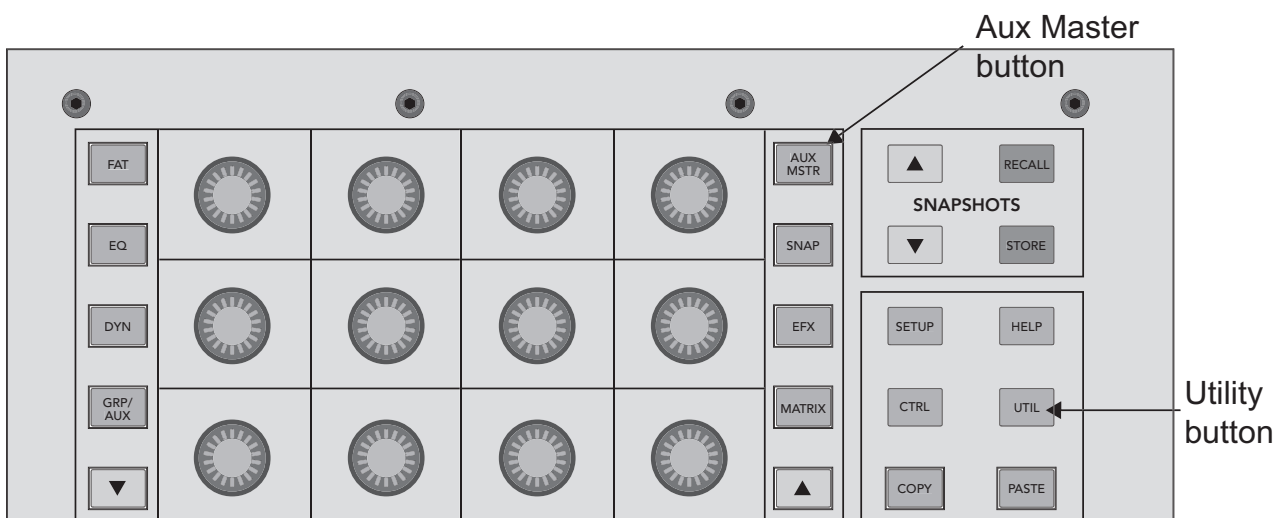


Figure 3-4 QuickMix area

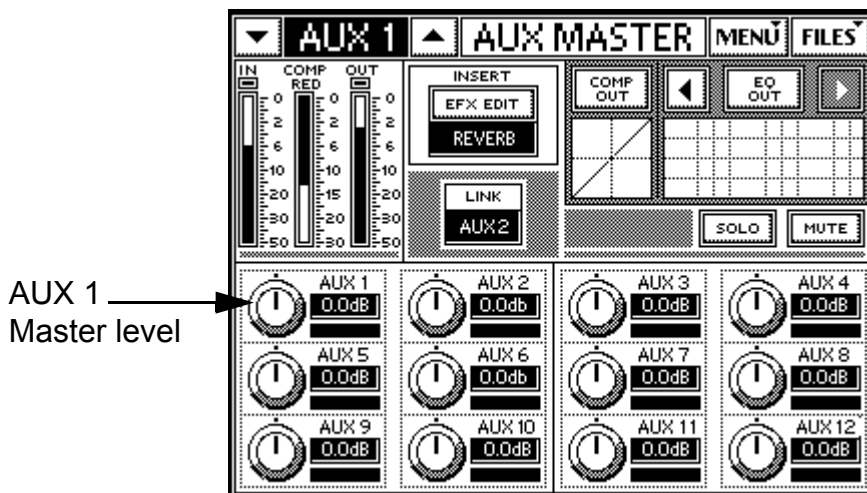


Figure 3-5 Aux Master screen

Engage and adjust the variable high-pass filter

17. Press **HPF** in the V-POT CONTROL area (Figure 3-2).
Now the high-pass filter can be adjusted with the channel V-Pots.
18. Engage the high-pass filter by pressing channel 1's V-Pot knob so the bottom red LED lights.
19. Rotate the V-Pot to adjust the filter in the range 20–400 Hz to remove unwanted low frequencies.

3.3 Connect a CD/Tape Device

This section illustrates how to connect a CD/tape device to the dedicated **CD/TAPE A** or **B** connectors (A = RCA, B = TRS), and to channels 23/24 to demonstrate stereo linking and channel strip processing.

Connect CD to CD/Tape input

1. Connect the CD player into CD/TAPE A or B (Figure 3-1).
2. Press the **UTIL** button (Figure 3-4).

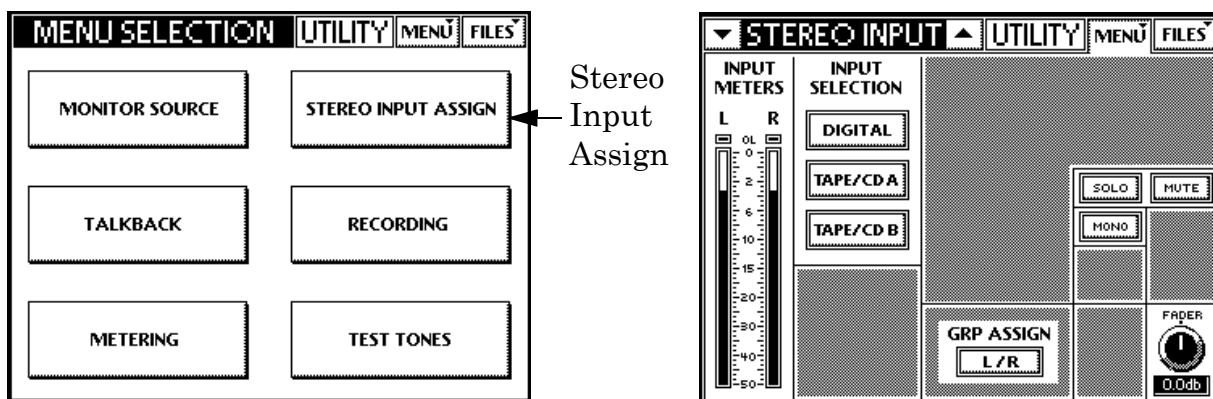


Figure 3-6 Stereo input assign

3. Touch **STEREO INPUT ASSIGN** on the Touchscreen (Figure 3-6).
4. Touch **TAPE/CD A** or **TAPE/CD B** in the INPUT SELECTION area (Figure 3-6).
5. Touch to activate **L/R** in the GRP ASSIGN area to route the mains.
6. Adjust **MUTE** and **SOLO** from the Touchscreen.
7. Adjust the stereo input fader to desired level from its QuickMix knob.

Connect CD to channels 23 and 24

1. Move the CD to the channel 23 and 24 **LINE** connectors.
2. Set the **LINE** switch to the down position (line level).
3. Press and hold channel 23 *and* 24's **SELECT** switches until the **Link Channels** dialog appears in the Touchscreen.
4. Touch **OK** to approve the channel linking.
5. Press the **PAN** button in the V-POT CONTROL area (Figure 3-3).
6. Turn channel 23's V-Pot hard left.
Channel 24 automatically pans in the opposite direction. Pretty cool!
7. Activate the **SOLO** button above the fader on either channel to solo.
The linked channel *does not* also solo.
8. Adjust the channel's **GAIN** knob and watch the meters to the right of the Touchscreen.
The level should be between -7 and -10 dBFS.
9. Repeat steps 7 and 8 for the other channel in the linked pair.

NOTE: Stereo linking always operates on a consecutive odd/even channel pair. The odd channel's parameters are copied to the even channel except Pan, which is inversely linked (i.e., hard left on odd channel translates to hard right on even channel).

Adjust EQ, Dynamics, and channel routing

1. With channel 23 and 24 selected, press the **EQ** button in the QuickMix area to display the channel EQ screen in the Touchscreen.
2. Touch the **EQ IN** toggle switch on the screen.
3. Use the 12 V-Pots to adjust the EQ parameters.
4. Press the **DYN** QuickMix button to display the Comp/Gate screen in the Touchscreen.
5. Touch the **GATE IN** or **COMP IN** toggle switches on the Touchscreen to engage the processors.
6. Use the 12 V-Pots to adjust the dynamics parameters.

NOTE: Press the Gate or Compressor graph on the Touchscreen to access a larger view of the individual dynamics processors.

7. Press the **GRP/AUX** QuickMix button to display the Group/Aux routing screens.

Groups 1–8 buttons on the Touchscreen are used for channel routing.

The 12 V-Pots are used to adjust the Channel Aux send levels.

8. Push the V-Pot knobs to toggle each Aux send between pre- and post-fader.

3.4 Aux Functions

This section discusses how to setup, route, and mix the Aux buses. Each of the 12 Aux masters have their own EQ and compressor/limiter.

1. Display the Aux masters by pressing the **AUX MSTR** button (Figure 3-4) to the right of the QuickMix knobs.
2. Select Aux master 1 by pressing the top-left QuickMix knob.
Figure 3-7 (left) shows Aux 1 selected.
3. Touch the EQ grid or press the **EQ** QuickMix button to display the EQ output parameters for selected Aux send 1 (right of Figure 3-7).

NOTE: The **EQ IN/OUT** button is located on the upper right of the Touchscreen.

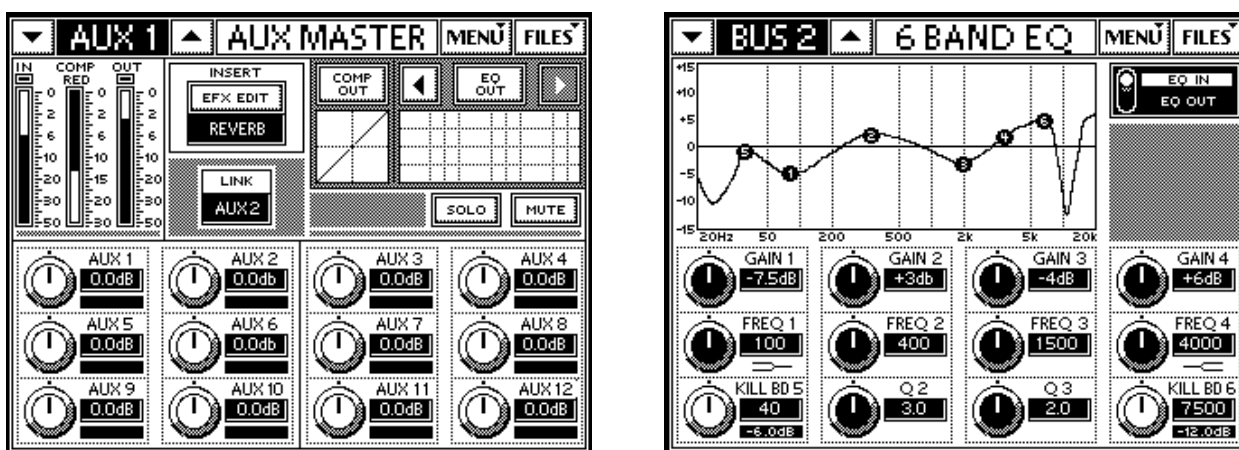


Figure 3-7 Aux Master (left) and EQ (right) screens

The EQ has six bands:

- two full parametric bands (bands 2 and 3);
- high- and low-shelf filters (bands 1 and 4);
- two Kill filters (bands 5 and 6) to remove narrow bands of unwanted frequencies. Push the Kill filter knobs to cycle through -6, -12, or -18 dB. As the amount of cut increases, the filter Q increases (i.e., bandwidth narrows). Turn the knob to adjust the frequency.

The channel aux levels are set with the channel V-Pots by pressing the desired Aux number in the V-POT CONTROL area. All 12 Aux levels for a selected channel can be set by pressing the **GRP/AUX** QuickMix button.

Aux Routing Examples

To send mic channel 1 to all monitors:

1. Press channel 1's **SELECT** button.
2. Press the **GRP/AUX** QuickMix button.
3. Adjust the QuickMix knobs to set each Aux level.

To set one monitor mix:

1. Press the desired Aux number button in the AUX SENDS area.
2. Use each channel's V-Pots to set the mix.

3.5 Effects

Four effects processors can each use one of the following effects: reverb, reverb through gate, mono/stereo/ping pong delay, chorus, and flange. The default effect sends are Aux sends 9–12 but any Aux or Matrix sends can be used. The effect returns are on the Returns bank.

1. Press the **ANLG** bank button.
2. Press **AUX SENDS 9** in the V-POT CONTROL area.
3. Turn channel 1's V-Pot to 3:00 to send channel 1 to Aux 9.
4. Press the **EFX** button in the QuickMix area.

The **INTERNAL** effects screen displays on the Touchscreen (left of Figure 3-8).

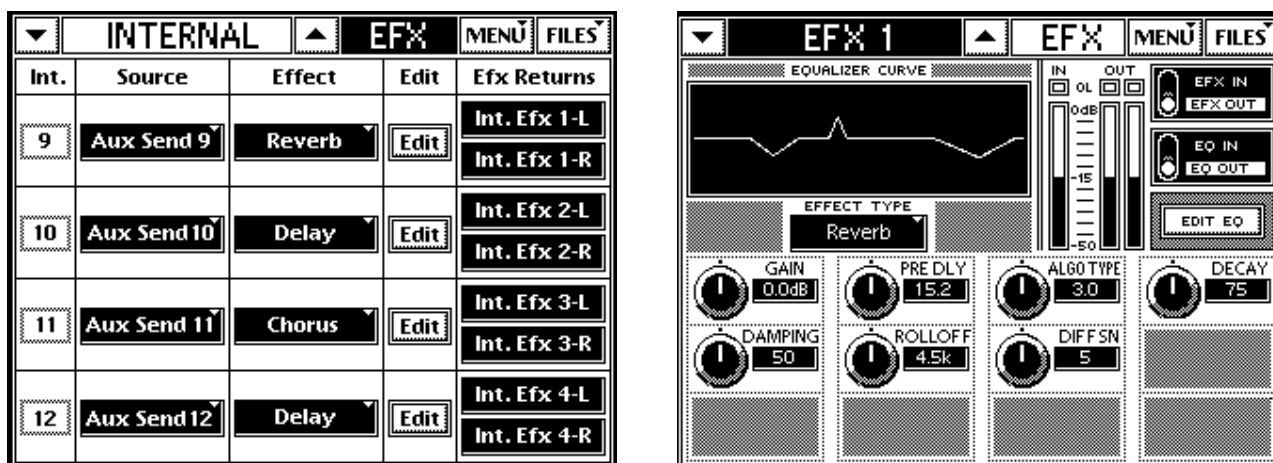


Figure 3-8 Internal Effects and Reverb screens

5. Touch the Reverb's **Edit** button to edit its parameters on its own screen (right of Figure 3-8).
6. Touch **EFX IN** to activate the reverb.
7. Press the **RTRNS** bank button.
8. Speak into the mic and increase the Returns levels (INT EFX 1L and INT EFX 1R) until you hear sufficient reverb.

Chapter 4: TT24 Specifications

Analog	
Mic Preamp	
Frequency response	+0, -2 dB, 10 Hz to 20 kHz (Mic In to Insert Out)
Distortion (THD + N)	< 0.003% @ +20 dBu output, 20 Hz to 20 kHz (Mic In to Insert Out)
Noise	
	20 Hz to 20 kHz BW (150 Ω source impedance)
Equivalent Input Noise (EIN)	-128 dBu
Residual Noise	-103 dBu (Mic In to Insert Out @ 0 dB gain)
Common Mode Rejection Ratio (CMRR)	>60 dB @ 1 kHz, gain @ maximum (Mic In to Insert Out)
Rise Time	< 3 μ s
Slew Rate	3.6 V/ μ s
Input Gain Control Range	
Mic In	0 dB to +60 dB
Line In	-20 dB to +40 dB
Phantom Power	48 VDC
Input Impedance	
Mic Input	2 k Ω , balanced
Line Input	10 k Ω
Aux Returns, CD/Tape A and B	10 k Ω
Maximum Input Level	
Mic Input	+22 dBu
Line Input	+22 dBu
Aux Returns, CD/Tape A and B	+22 dBu

Output Impedance	
L/R/C-Mono, Group/Matrix Out	150 Ω
Aux Send, Monitor Out	150 Ω
CD/Tape A and B Out	600 Ω
Maximum Output Level	
Insert Out	+22 dBu
L/R/C-Mono, Group/Matrix Out	+26 dBu
Aux Send, Monitor Out	+21 dBu
CD/Tape A and B Out	+22 dBu
Phones Out	500 mW into 100 Ω
System	
Frequency Response (Gain at unity) Mic Input to Main Output	+0, -1 dB, 10 Hz to 20 kHz @ 44.1 kHz +0, -2 dB, 10 Hz to 40 kHz @ 96 kHz +0, -0.5 dB, 14 Hz to 27.5 kHz @ 96 kHz
Distortion (THD + N)	
Mic Input to Main Output	< 0.02% @ +4 dBu input, 44.1 kHz, 10 Hz to 20 kHz < 0.03% @ +4 dBu input, 96 kHz, 10 Hz to 20 kHz
AES Input with SRC to AES Output	< 0.0002% @ -10 dBFS input, 44.1 kHz, 10 Hz to 22.05 kHz < 0.0006% @ -10 dBFS input, 96 kHz, 10 Hz to 48 kHz
Signal to Noise Ratio	-78 dBu (ref. +4 dBu Mic In to Main Out)
Dynamic Range	101 dB (Mic In to Main Out)
Maximum Voltage Gain	96 dB (Mic In to Main Out)
Crosstalk	
Adjacent Inputs	-110 dB @ 1 kHz
Adjacent Main Outputs	-95 dB @ 1 kHz
Adjacent Aux Outputs	-115 dB @ 1 kHz

Digital	
Faders	
Type	100 mm motorized, movement sensitive
Resolution	128 steps
Sampling Frequency	44.1, 48, 88.2, 96 kHz (Internal and External)
Digital Signal Processing	32-bit floating point resolution
Propagation Delay (Mic In to Main Out)	< 3.8 ms @ 44.1 kHz < 1.7 ms @ 96 kHz
Word Clock Input	
Minimum Level	0.4 V p-p
Duty Cycle	50%
Impedance	75 Ω
External Word Clock Lock Range	44.1 kHz = 42.5 kHz – 45.8 kHz 48 kHz = 46.4 kHz – 49.4 kHz 88.2 kHz = 85.0 kHz – 90.7 kHz 96 kHz = 92.2 kHz – 98.2 kHz
Word Clock Output	
Open Circuit Level	5 V p-p
Duty Cycle	50%
Impedance	75 Ω
AES Input (IEC-60958-3)	
Sample Rate with SRC	32 kHz – 96 kHz
Sample Rate without SRC	System sample rate exactly
Maximum Level	0.4 V p-p
Impedance	110 Ω , transformer coupled
AES Output (IEC-60958-3)	
Sample Rate	System rate or switchable half system rate
Level into 110 Ω	5 V p-p
Impedance	110 Ω , transformer coupled

S/PDIF Input	
Sample Rate with SRC	32 kHz – 96 kHz
Sample Rate without SRC	System sample rate exactly
Minimum Level	0.4 V p-p
Impedance	75 Ω
S/PDIF Output	
Sample Rate	System rate or switchable half system rate
Level into 75 Ω	0.5 V p-p
Impedance	75 Ω , transformer coupled
General	
AC Power Requirements	100–240 VAC, 50–60 Hz, auto-switching
Fuse	6 A/250 V
Operating Temperature	10°C–40°C (50°F–104°F)
Physical Dimensions	
Height	10.4 in/265 mm
Width	42.6 in/1083 mm (including handles)
Depth	25.0 in/636 mm
Weight	71.0 lb/32.2 kg

Disclaimer

Since we are always striving to make our products better by incorporating new and improved materials, components, and manufacturing methods, we reserve the right to change these specifications at any time without notice.

Appendix A: TT24 Configurations and Block Diagrams

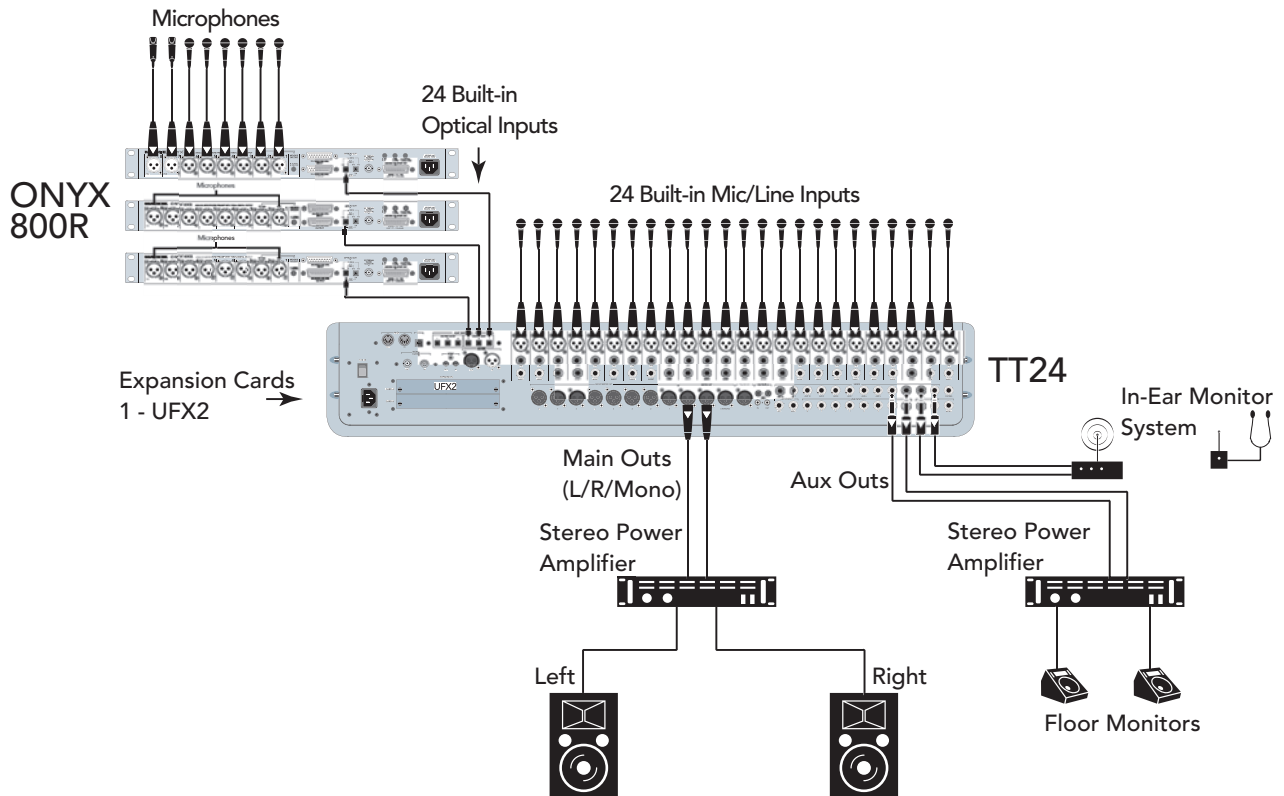


Figure A-1 48-channel TT24 system

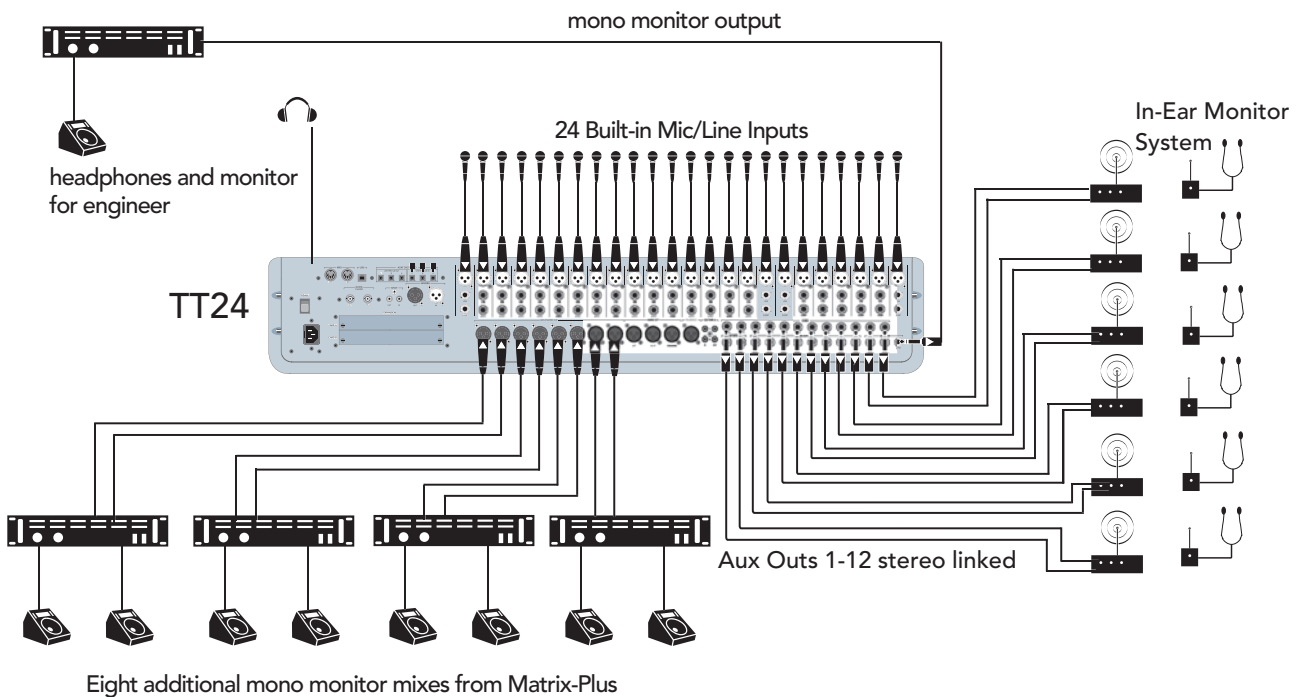


Figure A-2 TT24 system with in-ear monitors

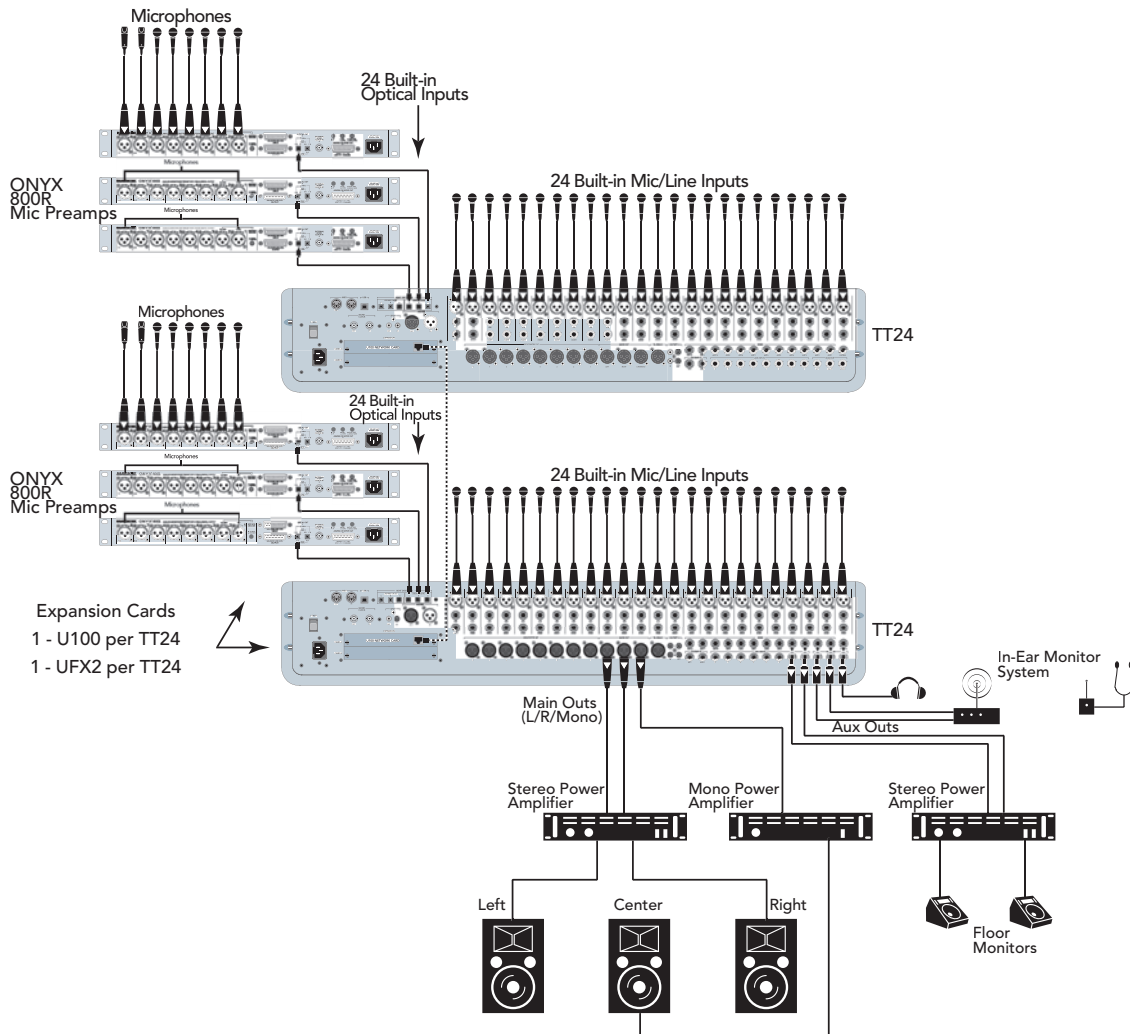


Figure A-3 96-channel system with two TT24s

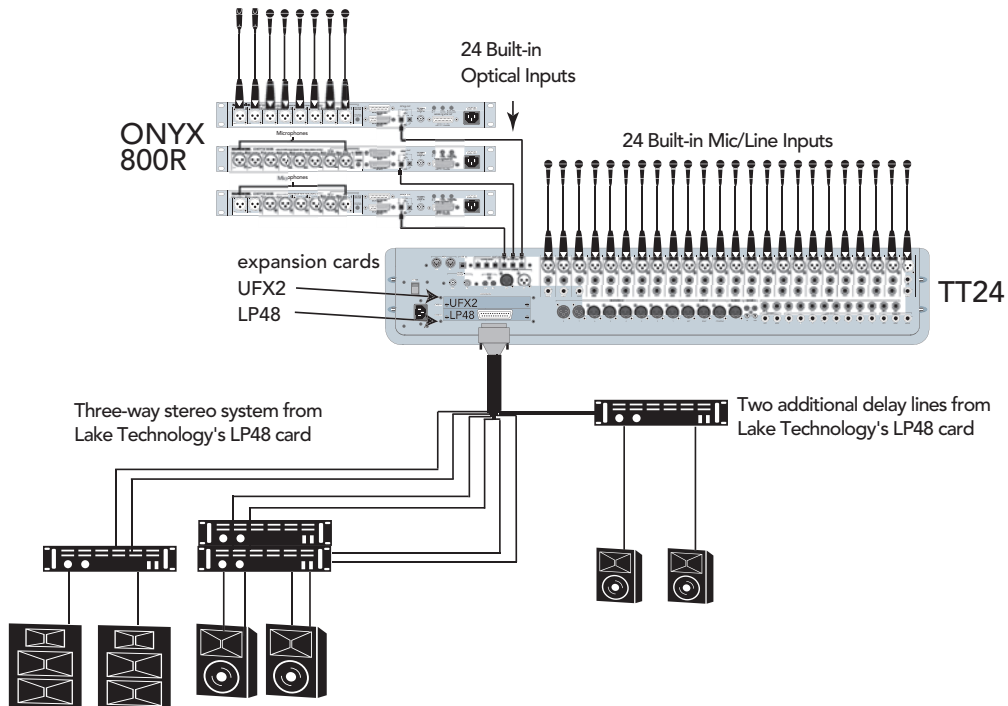


Figure A-4 Three-way stereo system using Lake Technology's LP48 expansion card

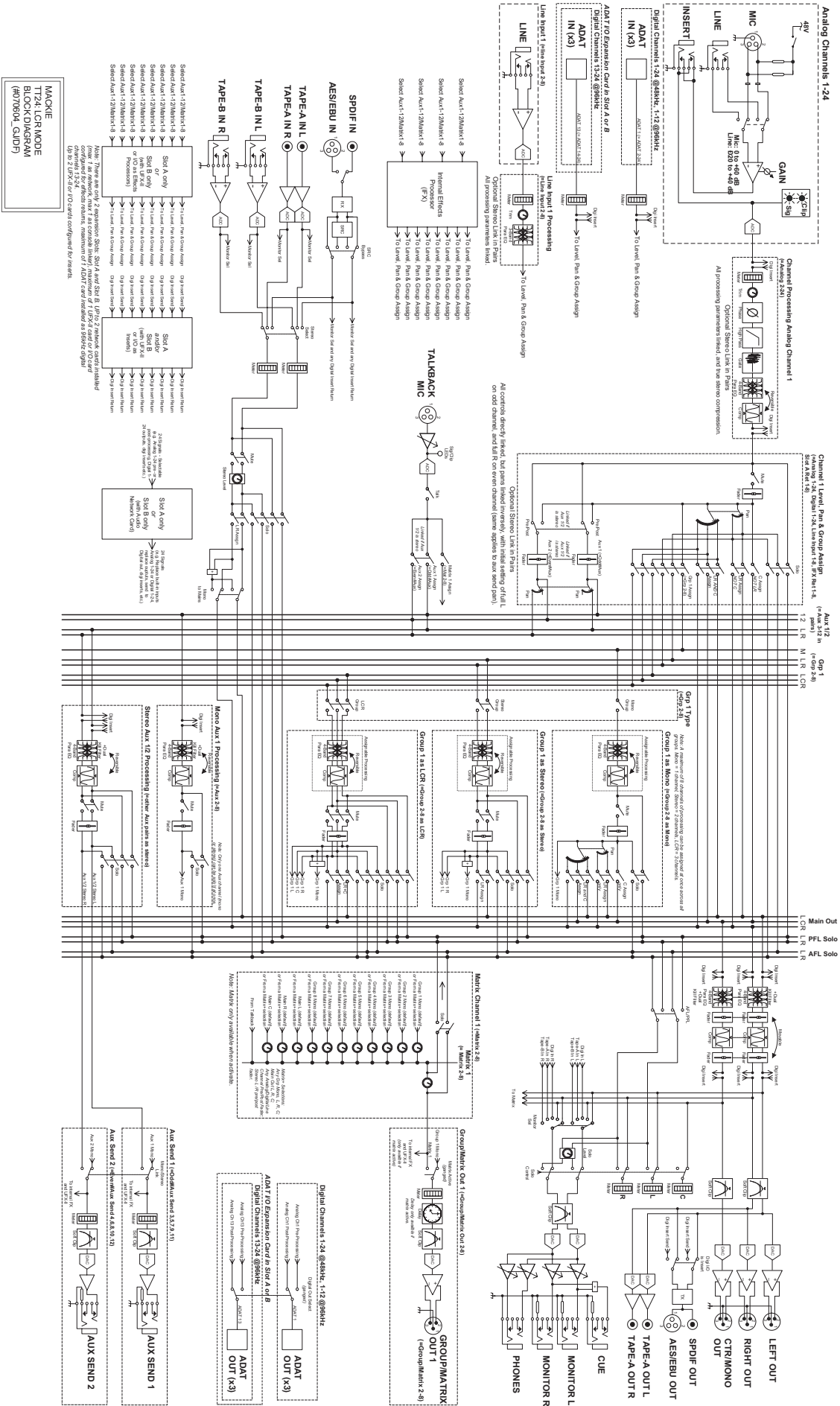


Figure A-6 TT24 in LCR mode

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